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COGNITIVE STIMULATION IN ADOLESCENTS AT RISK OF
EXCLUSION USING THE BAPNE® METHOD

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Abstract

In this paper we study the viability of an intervention using cognitive stimulation through the BAPNE® Method to benefit a group of young adolescent in an educational establishment in an area of very difficult socio-economic conditions. In addition, experimental research has been also conducted to demonstrate that this intervention can improve impulse control amongst the group under study. The experiment was carried out with a total of N=70 subjects divided between an experimental group and a control group. The intervention in the experimental group was carried out following the series of activities in the BAPNE® Method set out in the Bodypercussion- Programación didáctica (Volumes 1 and 2) teaching manuals during 25 weeks but the control group followed their normal music curriculum. The evaluation tools used to measure executive function were: the Controlled Oral Word Association Test (COWAT - F.A.S. & Animals), the Digit Span subtest (Digit Span Forward and Digit Span Backward), the Stroop Color and Word Test (SCWT) and the Trail Making Test (TMT). The data collection was analysed statistically using IBM SPSS v24 for Mac software and the results show that, between the pre- and the post-test, this intervention has visibly improved the inhibitory control and the verbal fluency amongst the experimental group.

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Keywords: Adolescence, BAPNE® method, executive functions, music, psychomotor coordination, risk of exclusion.



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1. Introduction

Various authors have studied the effects of music on child development and have shown that the practice of music improves social integration (Fabra-Brell & Romero-Naranjo, 2017; Kokotsaki & Hallam, 2007) and contributes notably to cognitive development (Altenmüller & Gruhn, 2002). It has been proven that musical training produce specific improvements in the executive functions (EF), including childhood singing games and games involving motor coordination (Sulkin & Brodsky, 2007). Above all, as signalled by recent studies, they particularly improve inhibitory control (Sachs, Kaplan, Sarkissian, & Habibi, 2017; Habibi, Damasio, Ilari, Elliott, & Damasio, 2018). For this reason, there are an increasing number of studies which show the link between practising music, motor development, coordination and improvement in the EF (Jaschke, Honing, & Scherder, 2018; Cameron et al, 2012; Piek et al., 2004) as well as in language skills in adolescence (Tierney, Krizman, & Kraus, 2015).

In this sense, and with reference to the group under study in this paper, it is necessary to highlight the significant degree of biological and psychosocial change during adolescence. A suitable social context is needed during this time so that an adolescent can become, by means of interaction with the constant changes in their social environment, a successful adult (Blakemore & Mills, 2014). Therefore, despite the fact that adolescence is a period which generally shows an overall improvement in cognition, when considering the socio-educational context of the group under study it is important to bear in mind that long-lasting exposure to a damaging environment of social exclusion may increase the risk of suffering from several different development disorders, such as mood disorders (Blakemore, 2008). The American Psychological Association (2003) sees social exclusion and poverty as two phenomena which affect individuals both physically and mentally, and which are linked to socioeconomic status (Saegert et al., 2007). Furthermore, it is known that the EF are crucial for carrying out both cognitive and motor learning processes (Diamond, 2000) and it has been shown that growing up in areas of low socioeconomic status (SES) increases the risk of delayed motor, language, and reading development (Kraus et al., 2014; McPhillips & Jordan-Black, 2007). But, on the other hand, studies point to the fact that the development of EF, particularly inhibitory control, is linked both to attention span and motor development (Pons-Terrés et al., 2014; Sergeant, 2000) and it has been shown that improved motor coordination development in children has a positive effect on processing of symbols, both in terms of language and mathematics (Berger, 2010; Holtzer et al., 2007).

In this way, despite the fact that its specific aim is not the teaching of music, the BAPNE® Method (Romero-Naranjo, Summer, & Palencia Pérez, 2012) has emerged as an innovative strategy of facilitated musical training which aims primarily to stimulate and promote the socioemotional and cognitive development (Cozzutti, Guaran, Blessano, & Romero-Naranjo, 2017; Jiménez-Molina, Vicedo-Cantó, Sayago-Martínez, & Romero-Naranjo, 2017). Furthermore, due to its multidimensional contribution (to cognitive, socioemotional, and the psychomotor development), the BAPNE® Method promotes development of the whole child, as it fosters other aspects which are essential for reaching adequate psycho-evolutionary development (Moral-Bofill, Romero Naranjo, Albiar-Aliaga, & Cid-Lamas, 2015; Conti & Romero-Naranjo, 2017; Cozzutti, Blessano, De Biaggio, Tomasin, & Romero-Naranjo, 2017; Fabra-Brell & Romero-Naranjo, 2017; Presti & Romero-Naranjo, 2017). Therefore, the BAPNE® Method (based on biomechanics, anatomy, psychology, neuroscience, and ethnomusicology, the disciplines which give rise

to the acronym) is focussed on the benefits of neuromotor and multiple intelligences development (Romero-Naranjo et al., 2012; Everest & Gardner, 2016). The method is based on the use of the teaching of body percussion (Trives-Martínez et al., 2014) and the practice of music, without using instruments (the body is the instrument), as a neuromotor strategy based on the dissociation of the lower and upper limbs and the voice to stimulate cognitive, socioemotional, psychomotor and neuro-rehabilitative development. In this way, and through direct musical practice, linked to movement, rhythm, melody, motor coordination and language, the BAPNE® Method develops processes such as multi-tasking, various types of attention, working memory, inhibitory control (Jauset-Berrocal, Tripovic, & Romero-Naranjo, 2014), and uses stimuli which interact with other non-musical areas of the brain (Sulkin & Brodsky, 2007).

Thus, the structures and neuroanatomical functions of these non-musical areas are developed through the transfer effect (Jaschke et al., 2018; Rauscher & Hinton, 2006) driven by neurocognitive plasticity, which is exercised by the musical training (Herholz & Zatorre, 2012).

2. Problem Statement

The BAPNE® Method has been used as a means of therapy and treatment (Romero-Naranjo & Naranjo, 2013) for groups considered at risk. These have included a group of drug addicts in rehabilitation (Romero-Naranjo et al., 2014), individuals suffering from dementia (Cavan, Naranjo, & Bagolin, 2017), as a means of social inclusion, as a treatment for dyslexia (Marcuzzi & Romero-Naranjo, 2017) and amongst patients suffering from depression (Salerno, Cefaratti, & Romero-Naranjo, 2017). Given the diverse nature of the groups studied thus far, these studies suggest that the BAPNE® Method can be effective amongst populations considered to be at social risk. However, as far as we know, by looking over the review articles (Romero-Naranjo, 2013), academic metasearch engines (Web of Science, Jstor, PubMed, Eric, Scopus, CINHALL and PEDro) and consulting high-impact articles, this is the first experimental and viability study of the BAPNE® Method amongst a group of young teenagers at risk of social exclusion

3. Research Questions

- Is it viable to put into place a programme of cognitive stimulation using the BAPNE® Method amongst a group of young teenagers at risk of social exclusion?
- Can the BAPNE® Method significantly increase the development of the EF in the group under study and improve their social surroundings?

4. Purpose of the Study

- To evaluate the levels of risk and vulnerability of a pilot group of young teenagers in their first year of secondary school in an educational establishment in an area of very difficult socio-economic conditions.
- To check the viability of the use of a programme of cognitive stimulation using the BAPNE® Method amongst a group of young adolescents at risk of social exclusion.

- To show through experiments that by means of a programme of cognitive stimulation using the BAPNE® Method amongst a group of young adolescents at risk of social exclusion it is possible to significantly increase the development of the EF.

5. Research Methods

5.1. Context

The experimental investigation was carried out with a total of N=70 subjects in their first year of secondary school, divided between an experimental group and a control group, both from areas with similar socio-economic and educational characteristics in the province of Barcelona.

5.1.1. Experimental group

The intervention involving cognitive stimulation by means of the BAPNE® Method was carried out at the INS Pedraforca, situated in the city of Hospitalet de Llobregat. This establishment has been classed by the regional Government of Catalunya's Educational Inspection Board as being in an area of very difficult socio-economic conditions (D'Avaluació, 2017). Furthermore, 95% of the student body is of immigrant origin and 56% are recent immigrants. This is one of the reasons why the student body of these establishments is considered a group of social exclusion. The experimental group (n=39) consisted of 19 girls and 20 boys aged between 12 and 15 years of age.

Initial assessment

In order to check the viability of the study in terms of the choice of group and their being at risk of social exclusion, given the multiple risk factors to which the studied population is exposed (low SES, segregation, newly-arrived students, etc.), an initial assessment based on interviews and projective techniques as a empirical instruments of qualitative methodology consistent with the complexity of the population under study (Sneiderman, 2011) was carried out.

This was done by using the emotional and development indicators proposed by Koppitz (2006) for the Human Figure Drawings Test (HFDT) alongside storytelling and semi-structured interviews with teachers and school staff. The teaching and non-teaching staff from the establishment were selected according to their relationships with the students under study. They included the group's music teacher, two form tutors, the child-psychologist, the social integration coordinator and the school receptionist.

In this way, using the development and emotional upset indicators of this method, the results show that 31% of the student body is below the level of maturity expected for their age and 74% shows signs of psychological stress. Furthermore, the interviews with the academic staff reveal a high degree of segregation within the school, high levels of absenteeism, illiteracy, poor study habits, little family involvement in their child's education, and traumatic experiences due to the break-up of the family unit caused by migration. Therefore, on the basis of these results, we consider that the group under study can be seen to be at risk of social exclusion.

5.1.2. Control group

The control group of the study was chosen from the IES Verge de les Neus, situated in the city of Santa Coloma (area of similar socio-economic characteristic to Hospitalet de Llobregat). The control group (n=31) consisted of 16 girls and 15 boys aged between 12 and 14 years of age.

5.2. Experimental evaluation tools and data collection procedure

In order to measure initial EF levels, a set of neuropsychological measurement tests was designed using the Stroop Color and Word Test (SCWT) in its spanish adaptation published by TEA (2010), the Trail Making Test (TMT), the Controlled Oral Word Association Tests (COWAT; Benton, Hamsher, & Sivan, 1989) in its 'F.A.S.' and 'Animals' variants of the spanish adaptation for young population (Casals-Coll et al., 2013) and two Digit Span subtests of the Wechsler Adult Intelligence Scale–Fourth Edition (WAIS–IV: Digit Span Forward and Digit Span Backward). The pre-test was carried out on both groups during November and, following this, the experimental group undertook a training programme by means of the BAPNE® Method between November 2016 and May 2017, participating in sessions twice a week for 50 minutes at a time. Throughout the programme, 33 such sessions were carried out within music lessons with the experimental group. However, the control group followed their normal scheme of work for music. Once the programme was completed, a post-test was carried out on both groups between May and June 2017.

5.3. BAPNE ® Method

Following the protocol of activities set out in the BAPNE® Method, which are published and set out in sequence in various manuals and articles with the Glossary, especially in the volumes 'Teaching programmes Volume 1 and 2', the intervention carried out on the experimental group could be adapted to the characteristics of the chosen population.

Viability study

To study the feasibility of the intervention, the music teacher was encouraged not to intervene to see if the BAPNE® trainers themselves could manage responsibility for the group. However, the groups were violent towards each other and paid minimal attention to the trainers. It could clearly be seen that a subsection of the group were passive participants and another subsection were overly active. The group would blame any classmates who made mistakes. After four weeks, and some violent incidents later, it was decided that the teacher should take the lead again and be responsible for the group. The fact that the trainer stopped being the authority figure was a positive change. As the intervention went on, the group showed a greater level of interest and enthusiasm to participate. On occasion, a student would start the session visibly upset, but would end the session smiling and happily participating. When students were removed from the group due to bad behaviour, they tended to show reluctance to leave the session. During the sessions, a healthy atmosphere of controlled freedom and free expression came about. That is why at a later stage, it was suggested that a assessment at the end of the sessions to allow the group to express any worries, which resulted in a significant decrease in violence between companions.

6. Findings

To verify the validity of the results collected, a model to compare the mean averages of the experimental and the control groups was used. The *t*-Student test was employed, with a level of statistical significance of 0.05 ($p < 0.05$). Furthermore, as there were two independent samples (control group $n=31$ and experimental group $n=39$), it was assumed that the total population $N=70$ showed a normal distribution. The statistical program used was IBM SPSS v24 for Mac.

6.1. Stroop Color and Word Test (SCWT)

Using the number of error as an indicator of the inhibitory control, especially in the interference test (C part) the pre-test for the Stroop Color and Word Test (SCWT) did not show significant differences between the two groups (the control group and the experimental group). However, the post-test showed statistically significant differences between the average number of errors made on the C part between the two groups, with a P value of 0.035 (Table 01). The difference between the averages in the experimental group and the control group was -0.865 (Table 1).

In terms of difference between the pre- and post-tests, when comparing the average number of errors made in part A, statistically significant differences were found between the two groups with a P value of 0.034. Similar results also occurred in C part with a P value of 0.02 (Table 01). This shows that the experimental group saw a greater reduction in the number of errors made than the control group (Figure 1 & 2).

Table 01. Average number of errors in the post-test scores in the Stroop Color and Word Test is lower in the experimental group (-0'865) with a more than enough statistical significance ($p=0.035$).

Independent Samples Test							
Levene's Test for Equality of Variances				t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
POST C-E	Equal variances assumed	11.755	0.001	-2.37	68	0.021	-0.865
	Equal variances not assumed			-2.187	38.762	0.035	-0.865
A-E	Equal variances assumed	4.021	0.049	-2.007	68	0.049	-0.59
	Equal variances not assumed			-2.179	52.922	0.034	-0.59
C-E	Equal variances assumed	0.217	0.642	-2.383	68	0.02	-1.268
	Equal variances not assumed			-2.331	57.809	0.023	-1.268

Note: (POST C-E) Average number of errors made on the C part between the two groups; (A-E) Error scores in reading the word (C-E) Error scores in the interference part.

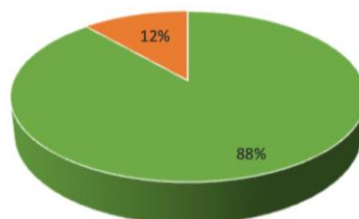


Figure 01. Difference between the post- and pre-test error scores in the Stroop Color and Word Test, which show a substantial reduction of errors in the experimental group (-88%) in comparison to the control group (-12%)

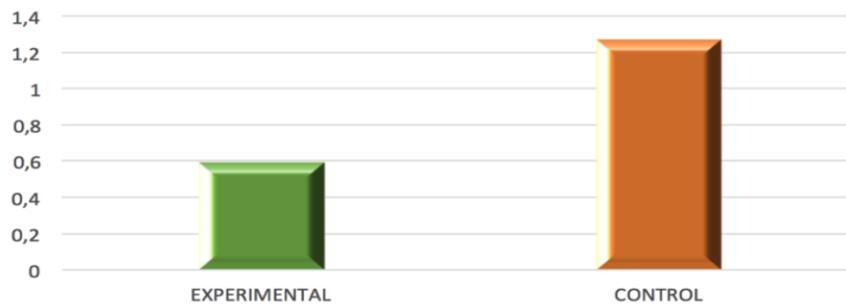


Figure 02. Average number of errors in the post-test scores in the Stroop Color and Word Test

6.2. Controlled Oral Word Association Test (COWAT-FAS)

In order to study verbal fluency, we used COWAT with the phonetic test of the letters 'F', 'A' and 'S' as an indicator of verbal fluency. Statistically significant differences were recorded with a P value of 0.001 (see Table 2) in the difference in the average number of words between the pre- and post-tests in both groups. In terms of difference between the pre- and post-tests in the total number of errors, a greater difference was found amongst the experimental group (see Figure 3).

Table 02. Average score for number of errors in post-test in the Controlled Oral Word Association Test (COWAT-FAS) is a lower for the experimental group with a substantial statistical significance ($p=0.001$).

Independent Samples Test							
		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
FAS - S	Equal variances assumed	0.49	0.831	3.389	68	0.001	2.129
	Equal variances not assumed			3.384	64.102	0.001	2.129
FAS - PT	Equal variances assumed	7.836	0.007	4.098	68	0	4.556
	Equal variances not assumed			4.308	64.925	0	4.556

Note: (FAS - S) Word score only for the letter 'S'; (FAS - PT) Word total score for the letters 'F', 'A' and 'S'.

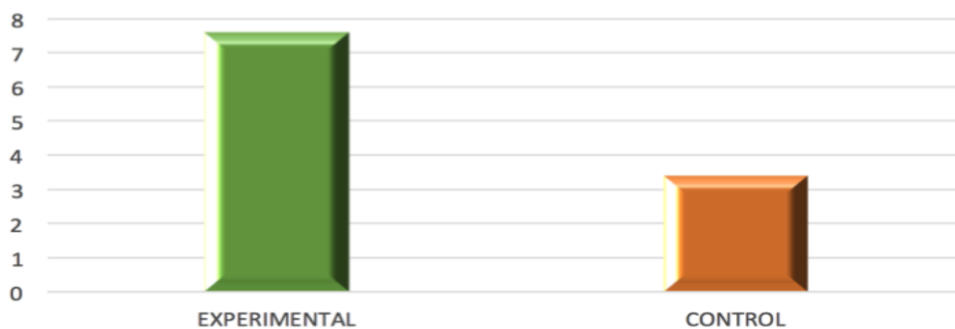


Figure 03. Difference between the pre- and post-tests of the total number of errors in the Controlled Oral Word Association Test (COWAT-FAS). In the experimental group, a greater decrease in the number of errors can be seen.

7. Conclusion

This study confirms the viability of a programme of intervention using the BAPNE® Method with the aim of stimulating the cognitive development of adolescents at risk of social exclusion. This represents a step forward in the application of this method with special groups. Furthermore, by responding to the social demands of the group under study, whose socioeconomic characteristics have a negative impact upon their cognitive and behavioural development (Kraus et al., 2014; OECD, 2011; Walper, 2009; McPhillips & Jordan-Black, 2007; Saegert et al., 2007), the results of this study empirically support the thesis that the BAPNE® Method can be considered a valid and effective non-pharmacological strategy to notably improve inhibitory control and verbal fluency amongst children and adolescents in highly difficult socio-economic conditions.

It is important to remember that the age group most at risk of poverty and social exclusion in the Member States (MS) of the European Union (EU) are those aged under 18 (Statistics Explained, 2015; Ron, 2013). It is for this reason that, in order to reduce social expenditure in the future, the European Commission, alongside other EU and MS institutions, are currently cooperating by means of the Open Method of Coordination (OMC) to combat the consequences of social exclusion and those factors which perpetuate the intergenerational transmission of poverty (ITP) (Ron, 2013) using strategies included in the Lisbon European Council and the current Europe 2020 (European Council, 2000 and 2010). In this way, the current study supports the theoretical constructs which report about lack of involvement and interest in education of children, typically exhibited by parents in families with low SES (Younge, 2013), the consequences of segregation processes in the education system (Jahan, 2017) and how a low SES is directly linked to cognitive impulsivity in children (Arán-Filippetti & Richaud de Minzi, 2012; Younge, 2013). It has been shown that there is a directly proportional relationship between SES and the level of development of inhibitory control, one of the most important EF related to SES in order to appropriately direct thought (Sheehy-Skeffington & Rea, 2017). Thus, from the recent discoveries, and bearing in mind that inhibitory control is the ability which allows our attention not to be distracted and diverted towards unfavourable sources (Lavie, 2010), it can be seen that developing inhibitory control is a crucial process for children and adolescents to help them avoid disruptive behaviours, to study and to achieve at school, all of them factors that contribute to leave ITP (OECD, 2011; Duarte, Ferrando-Latorre, & Molina, 2018). It is also important to consider that, whilst the link between cognitive achievement and SES has been shown, the exact causes of this phenomenon are still unknown (Arán-Filippetti & Richaud de Minzi, 2012). Furthermore, although social exclusion is strongly linked to poverty (Littlewood, Glorieux, & Jönsson, 2017), it is important to remember that ITP also depends on non-economic factors (such as education levels, sociocultural levels and the physical and mental health of householders), which have been shown to be even more decisive factors than poverty itself for ITP (Vauhkonen, Kallio, Kauppinen, & Erola, 2017).

Therefore, in the light of the review and considering the EF as non-economic factors which influence ITP, from the results presented in this paper, we can propose the working hypothesis that by strengthening inhibitory control, which is crucial for the development of the processes of decision making associated to SES (Sheehy-Skeffington & Rea, 2017), planning educational intervention using the BAPNE® Method could be a cognitive stimulation strategy to help combat the sociocultural causes of ITP. This study only offers preliminary support to our thesis regarding the use of the BAPNE® Method amongst adolescents at

risk of social exclusion. However, considering the responsibilities of public institutions, we can argue that the BAPNE® Method can be considered a suitable compensatory strategy in interventions with young adolescents in educational establishments in very difficult socio-economic conditions. And finally, we can also argue that, although this is an educational strategy (therefore we are talking about a solution in the medium- and long-term), a large-scale implementation could be an excellent opportunity to investigate and evaluate the effectiveness and impact that such action could have on society, beyond economic measures against the consequences of ITP.

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